Posudek diplomové práce

Matematicko-fyzikální fakulta Univerzity Karlovy

Autor práce	HongSonNgo
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Studijní program	Informatika **Studijní obor** Počítačová grafika a vývoj počítačových her

Autor posudku	Mgr. Jakub Gemrot, Ph.D.	**Role**	Oponent
Pracoviště	KSVI		

Text posudku:

This thesis presents a real-time ocean wave simulation system implemented on the GPU, grounded in Tessendorf's frequency-domain approach. The system incorporates various wave spectra (e.g., Phillips and TMA), directional spreading functions, and a stochastic tiling method designed to mitigate periodic artifacts typical of tiled simulations. Additional features include foam generation and interactive parameter control, allowing to balance visual realism with real-time performance.

The structure is clear: Chapters 1–4 cover the theoretical foundations - wave physics, optical modeling, Fourier methods, and tiling strategies - with commendable clarity and mathematical rigor. While being technically sound and well-structured, it does presume a reader with a strong background in ocean rendering. More visual aids and GPU-contextual commentary could have helped bridge the gap between abstract modeling and practical implementation.

Chapters 5 and 6 shift to implementation and results. The author correctly focuses on the challenge of removing visible tiling by combining multiple displacement maps. The system is demonstrated convincingly, and its performance and capabilities are evident in the rendered outputs.

Let me first note that I consider the topic to be of above-average difficulty - it spans spectral fluid modeling, GPU programming, and visual design. Successfully implementing such a system is a notable achievement, and the author clearly fulfills all objectives of the thesis assignment. The text is free of typographic or technical errors, concise, and complete.

That said, I would like to bring two shortcomings to attention:

1. Evaluation lacks objective metrics.
The quality of the rendered ocean is evaluated visually only via screenshots and spectrum plots. While these do show artifacts and improvements, the lack of quantitative analysis weakens the empirical credibility of the results. Established metrics like Spectral Energy Deviation, Mean Squared Error in frequency space, or L2 norms between target and synthesized spectra could and should have been used.

2. Implementation is a gray box.
Despite concluding that the system provides a foundation for future work, the thesis lacks a clear and explicit documentation of the code. The implementation section reads more like a user manual than a developer-facing description. Implementation challenges are not

discussed, the code architecture is not presented, and the accompanying code is undocumented all limiting the reusability and extensibility of the work.

I recommend this thesis for defense.

Práci doporučuji k obhajobě.

Práci nenavrhuji na zvláštní ocenění.

Pokud práci navrhujete na zvláštní ocenění (cena děkana apod.), prosím uveďte zde stručné zdůvodnění (vzniklé publikace, významnost tématu, inovativnost práce apod.).

Datum 27.5.2025 **Podpis**